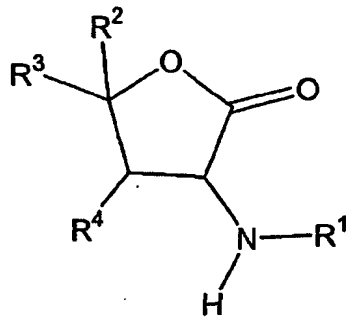
Claims:

1. Substituted γ-lactone compounds of the general formula I,



I

in which

R^1 denotes an optionally at least mono-substituted aryl or heteroaryl residue, an optionally at least mono-substituted aryl or heteroaryl residue attached via a C_{1-6} alkylene group, an optionally at least mono-substituted, saturated, branched or unbranched aliphatic C_{1-10} residue, an optionally at least mono-substituted, at least partially unsaturated, branched or unbranched aliphatic C_{2-10} residue or an optionally at least mono-substituted, saturated or at least mono-unsaturated cycloaliphatic C_{3-8} residue,

R^2 denotes an optionally at least mono-substituted, saturated, branched or unbranched aliphatic C_{1-10} residue or an optionally at least mono-substituted, at least partially unsaturated, branched or unbranched aliphatic C_{2-10} residue,

R^3 denotes an optionally at least mono-substituted aryl residue,

R^4 denotes H,

or

R^3 and R^4 together denote an optionally at least mono-substituted, saturated or at least mono-unsaturated aliphatic C_{3-7} residue, with the proviso that the residue R^2 in this case denotes an optionally at least mono-substituted aryl residue, an optionally at least mono-substituted, saturated, branched or unbranched aliphatic C_{1-10} residue or an optionally at least mono-substituted, at least partially unsaturated, branched or unbranched aliphatic C_{2-10} residue

in the form of the racemates, diastereomers or enantiomers thereof in the form of the base thereof or of a corresponding physiologically acceptable salt,

wherein the compounds of the general formula I, in which R^1 denotes a 2-, 4-, 6-trichlorophenyl or a tosyl residue, R^2 a methyl residue, R^3 a phenyl residue and R^4 denotes H, are excepted.

2. Substituted γ-lactone compounds according to claim 1, characterised in that R^1 denotes an optionally at least mono-substituted aryl or heteroaryl residue, preferably an optionally at least mono-substituted aryl residue.

3. Substituted γ-lactone compounds according to claim 1 or 2, characterised in that R^2 denotes an optionally at least mono-substituted, branched or unbranched C_{1-6} alkyl residue.

4. Substituted γ-lactone compounds according to one of claims 1 to 3, characterised in that R^3 denotes an optionally at least mono-substituted aryl residue and R^4 denotes H.

5. Substituted γ-lactone compounds according to one or more of claims 1 to 4:

3-(2-Chloro-4-fluoro-phenylamino)-5-(4-fluoro-phenyl)-5-methyl-dihydro-furan-2-one,

5-Methyl-3-(4-phenoxy-phenylamino)-5-phenyl-dihydro-furan-2-one,

3-(2-Chloro-phenylamino)-5-(4-fluoro-phenyl)-5-methyl-dihydro-furan-2-one,

3-(4-Chloro-2-methyl-phenylamino)-5-methyl-5-phenyl-dihydro-furan-2-one,

3-(2,4-Dichloro-phenylamino)-5-(4-fluoro-phenyl)-5-methyl-dihydro-furan-2-one,

3-(4-Chloro-3-trifluoromethyl-phenylamino)-5-methyl-5-phenyl-dihydro-furan-2-one,

3-(2,3-Dichloro-phenylamino)-5-(4-fluoro-phenyl)-5-methyl-dihydro-furan-2-one,

3-(4-Iodo-phenylamino)-5-methyl-5-phenyl-dihydro-furan-2-one,

3-(4-Chloro-2-fluoro-phenylamino)-5-(4-fluoro-phenyl)-5-methyl-dihydro-furan-2-one,

3-(2-Chloro-4-methyl-phenylamino)-5-methyl-5-phenyl-dihydro-furan-2-one,

3-(2-Chloro-4-methyl-phenylamino)-5-(4-fluoro-phenyl)-5-methyl-dihydro-furan-2-one,

3-(3,5-Dichloro-phenylamino)-5-methyl-5-phenyl-dihydro-furan-2-one,

3-(3,5-Dichloro-phenylamino)-5-(4-fluoro-phenyl)-5-methyl-dihydro-furan-2-one,

3-(4-Bromo-2-chloro-phenylamino)-5-(4-fluoro-phenyl)-5-methyl-dihydro-furan-2-one,

4-(5-Methyl-2-oxo-5-phenyl-tetrahydro-furan-3-ylamino)-benzonitrile,

5-(4-Chloro-phenyl)-3-(4-iodo-phenylamino)-5-methyl-dihydro-furan-2-one,

5-(4-Chloro-phenyl)-3-(2,4-dichloro-phenylamino)-5-methyl-dihydro-furan-2-one,

5-(4-Chloro-phenyl)-3-(2-chloro-phenylamino)-5-methyl-dihydro-furan-2-one,

3-(4-Chloro-2-methyl-phenylamino)-5-(4-chloro-phenyl)-5-methyl-dihydro-furan-2-one

3-(2-Chloro-4-fluoro-phenylamino)-5-(4-chloro-phenyl)-5-methyl-dihydro-furan-2-one,

3-(4-Chloro-2-fluoro-phenylamino)-5-(4-chloro-phenyl)-5-methyl-dihydro-furan-2-one,

3-(2-Chloro-4-methyl-phenylamino)-5-(4-chloro-phenyl)-5-methyl-dihydro-furan-2-one,

5-(4-Chloro-phenyl)-3-(2,3-dichloro-phenylamino)-5-methyl-dihydro-furan-2-one,

3-(4-Bromo-2-chloro-phenylamino)-5-(4-chloro-phenyl)-5-methyl-dihydro-furan-2-one,

5-(4-Chloro-phenyl)-3-(3,5-dichloro-phenylamino)-5-methyl-dihydro-furan-2-one,

3-(3,5-Dibromo-pyridin-2-ylamino)-5-methyl-5-phenyl-dihydro-furan-2-one,

5-(4-Chloro-phenyl)-3-(3,5-dichloro-pyridin-2-ylamino)-5-methyl-dihydro-furan-2-one,

5-(4-Chloro-phenyl)-5-methyl-3-(5-nitro-pyridin-2-ylamino)-dihydro-furan-2-one,

3-(3-Chloro-2-methyl-phenylamino)-5-(4-iodo-phenyl)-5-methyl-dihydro-furan-2-one,

5-(4-Bromo-phenyl)-3-(4-chloro-phenylamino)-5-methyl-dihydro-furan-2-one,

5-(3-Chloro-phenyl)-3-(4-chloro-phenylamino)-5-methyl-dihydro-furan-2-one,

3-(4-chloro-phenylamino)-5-(4-iodo-phenyl)-5-methyl-dihydro-furan-2-one,

5-(4-Bromo-phenyl)-3-(2-iodo-phenylamino)-5-methyl-dihydro-furan-2-one,

5-(3-Chloro-phenyl)-3-(2-iodo-phenylamino)-5-methyl-dihydro-furan-2-one,

5-(4-Iodo-phenyl)-3-(2-iodo-phenylamino)-5-methyl-dihydro-furan-2-one,

3-(2,4-Difluoro-phenylamino)-5-methyl-5-naphthalen-1-yl-dihydro-furan-2-one,

5-(4-Bromo-phenyl)-3-(4-iodo-phenylamino)-5-methyl-dihydro-furan-2-one,

5-(3-Chloro-phenyl)-3-(4-iodo-phenylamino)-5-methyl-dihydro-furan-2-one,

3-(4-Iodo-phenylamino)-5-methyl-5-naphthalen-1-yl-dihydro-furan-2-one,

5-(4-Bromo-phenyl)-3-(3,5-dichloro-phenylamino)-5-methyl-dihydro-furan-2-one,

5-(3-Chloro-phenyl)-3-(3,5-dichloro-phenylamino)-5-methyl-dihydro-furan-2-one,

3-(3,5-Dichloro-phenylamino)-5-(4-iodo-phenyl)-5-methyl-dihydro-furan-2-one,

3-(3,5-Dichloro-phenylamino)-5-methyl-5-naphthalen-1-yl-dihydro-furan-2-one,

5-(3-Chloro-phenyl)-5-methyl-3-phenylamino-dihydro-furan-2-one,

3-(2-Bromo-4-methyl-phenylamino)-5-(4-iodo-phenyl)-5-methyl-dihydro-furan-2-one,

3-(2-Bromo-4-methyl-phenylamino)-5-methyl-5-naphthalen-1-yl-dihydro-furan-2-one,

3-(5-Chloro-2-methyl-phenylamino)-5-methyl-5-(5,6,7,8-tetrahydro-naphthalen-2-yl)-dihydro-furan-2-one,

3-(4-Bromo-2-fluoro-phenylamino)-5-isopropyl-5-phenyl-dihydro-furan-2-one,

5-(2,5-Dimethoxy-phenyl)-5-methyl-3-(5-trifluoromethyl-pyridin-2-ylamino)-dihydro-furan-2-one,

5-(3,5-Dimethoxy-phenyl)-5-methyl-3-(5-trifluoromethyl-pyridin-2-ylamino)-dihydro-furan-2-one,

3-(3-Bromo-5-methyl-pyridin-2-ylamino)-5-(2-methoxy-phenyl)-5-methyl-dihydro-furan-2-one,

3-(3-Bromo-5-methyl-pyridin-2-ylamino)-5-(2,5-dimethoxy-phenyl)-5-methyl-dihydro-furan-2-one,

3-(3-Bromo-5-methyl-pyridin-2-ylamino)-5-(3,5-dimethoxy-phenyl)-5-methyl-dihydro-furan-2-one,

3-(5-Bromo-3-methyl-pyridin-2-ylamino)-5-(2-methoxy-phenyl)-5-methyl-dihydro-furan-2-one,

3-(2-Chloro-pyridin-3-ylamino)-5-(2-methoxy-phenyl)-5-methyl-dihydro-furan-2-one,

3-(5-Bromo-pyridin-2-ylamino)-5-(2,5-dimethoxy-phenyl)-5-methyl-dihydro-furan-2-one,

3-(3-Chloro-5-trifluoromethyl-pyridin-2-ylamino)-5-(2,5-dimethoxy-phenyl)-5-methyl-dihydro-furan-2-one,

5-(2-Methoxy-phenyl)-5-methyl-3-(pyridin-2-ylamino)-dihydro-furan-2-one,

3-[5-(2,5-Dimethoxy-phenyl)-5-methyl-2-oxo-tetrahydro-furan-3-ylamino]-pyrazole-4-carboxylic acid ethyl ester,

3-[5-(3-Bromo-phenyl)-5-methyl-2-oxo-tetrahydro-furan-3-ylamino]-pyrazole-4-carboxylic acid ethyl ester,

3-[5-(3-Bromo-phenyl)-5-methyl-2-oxo-tetrahydro-furan-3-ylamino]-5-methylsulfanyl-pyrazole-4-carbonitrile,

3-[5-(2,5-Dimethoxy-phenyl)-5-methyl-2-oxo-tetrahydro-furan-3-ylamino]-pyrazole-4-carbonitrile,

3-(4-Bromo-pyrazol-3-ylamino)-5-(3,5-dimethoxy-phenyl)-5-methyl-dihydro-furan-2-one,

3-(4-Bromo-5-phenyl-2H-pyrazol-3-ylamino)-5-(2-methoxy-phenyl)-5-methyl-dihydro-furan-2-one,

3-(8-Hydroxy-quinolin-2-ylamino)-5-(2-methoxy-phenyl)-5-methyl-dihydro-furan-2-one,

5-(2,5-Dimethoxy-phenyl)-3-(8-hydroxy-quinolin-2-ylamino)-5-methyl-dihydro-furan-2-one,

5-(2-Methoxy-phenyl)-5-methyl-3-(pyrazin-2-ylamino)-dihydro-furan-2-one,

5-(3-Bromo-phenyl)-5-methyl-3-(4-methyl-pyrimidin-2-ylamino)-dihydro-furan-2-one,

2-[5-(3,5-Dimethoxy-phenyl)-5-methyl-2-oxo-tetrahydro-furan-3-ylamino]-4-propyl-pyrimidine-5-carboxylic acid ethyl ester,

5-(2-Methoxy-phenyl)-5-methyl-3-(pyrimidin-2-ylamino)-dihydro-furan-2-one,

3-(4-Chloro-3-trifluoromethyl-phenylamino)-5-phenyl-5-propyl-dihydro-furan-2-one,

3-(2-Chloro-phenylamino)-5-phenyl-5-propyl-dihydro-furan-2-one,

3-(2-Chloro-4-fluoro-phenylamino)-5-phenyl-5-propyl-dihydro-furan-2-one,

3-(4-Chloro-2-fluoro-phenylamino)-5-phenyl-5-propyl-dihydro-furan-2-one,

3-(2-Chloro-4-methyl-phenylamino)-5-phenyl-5-propyl-dihydro-furan-2-one,

3-(2-Oxo-5-phenyl-5-propyl-tetrahydro-furan-3-ylamino)-pyrazole-4-carboxylic acid ethyl ester,

3-(5-Hydroxy-4-phenylazo-pyrazol-3-ylamino)-5-phenyl-5-propyl-dihydro-furan-2-one,

3-(4-Bromo-5-phenyl-pyrazol-3-ylamino)-5-phenyl-5-propyl-dihydro-furan-2-one,

5-Methylsulfanyl-3-(2-oxo-5-phenyl-5-propyl-tetrahydro-furan-3-ylamino)-pyrazole-4-carbonitrile,

3-(5-Butyl-2-oxo-5-phenyl-tetrahydro-furan-3-ylamino)-pyrazole-4-carboxylic acid ethyl ester,

5-Butyl-3-(5-hydroxy-4-phenylazo-pyrazol-3-ylamino)-5-phenyl-dihydro-furan-2-one,

3-(4-Bromo-5-phenyl-pyrazol-3-ylamino)-5-butyl-5-phenyl-dihydro-furan-2-one,

3-(5-Butyl-2-oxo-5-phenyl-tetrahydro-furan-3-ylamino)-5-methylsulfanyl-pyrazole-4-carbonitrile,

3-(5-Butyl-2-oxo-5-phenyl-tetrahydro-furan-3-ylamino)-pyrazole-4-carbonitrile,

5-Butyl-3-(2-phenoxy-phenylamino)-5-phenyl-dihydro-furan-2-one,

5-Biphenyl-4-yl-3-(2,4-dichloro-phenylamino)-5-methyl-dihydro-furan-2-one,

5-Biphenyl-4-yl-3-(2-chloro-phenylamino)-5-methyl-dihydro-furan-2-one,

5-Biphenyl-4-yl-3-(2-chloro-4-fluoro-phenylamino)-5-methyl-dihydro-furan-2-one,

3-(5-Biphenyl-4-yl-5-methyl-2-oxo-tetrahydro-furan-3-ylamino)-pyrazole-4-carboxylic acid ethyl ester,

5-Biphenyl-4-yl-3-(4-bromo-5-phenyl-pyrazol-3-ylamino)-5-methyl-dihydro-furan-2-one,

3-(3,5-Dichlorophenylamino)-5-methyl-5-phenyl-dihydrofuran-2-one,

3-(3,5-Dichlorophenylamino)-5-methyl-5-o-tolyl-dihydrofuran-2-one,

3-(3,5-Dichlorophenylamino)-5-(4-fluorophenyl)-5-methyl-dihydrofuran-2-one,

5-(2-Chlorophenyl)-3-(3,5-dichlorophenylamino)-5-methyl-dihydrofuran-2-one,

5-(4-Chlorophenyl)-3-(3,5-dichlorophenylamino)-5-methyl-dihydrofuran-2-one,

5-(3-Bromophenyl)-3-(3,5-dichlorophenylamino)-5-methyl-dihydrofuran-2-one,

5-(4-Bromophenyl)-3-(3,5-dichlorophenylamino)-5-methyl-dihydrofuran-2-one,

3-(3,5-Dichlorophenylamino)-5-(4-iodophenyl)-5-methyl-dihydrofuran-2-one,

3-(3,5-Dichlorophenylamino)-5-(2-methoxyphenyl)-5-methyl-dihydrofuran-2-one,

3-(3,5-Dichlorophenylamino)-5-(3-methoxyphenyl)-5-methyl-dihydrofuran-2-one,

3-(3,5-Dichlorophenylamino)-5-(4-methoxyphenyl)-5-methyl-dihydrofuran-2-one,

3-(3,5-Dichlorophenylamino)-5-(2,4-dimethoxyphenyl)-5-methyl-dihydrofuran-2-one,

3-(3,5-Dichlorophenylamino)-5-(2,5-dimethoxyphenyl)-5-methyl-dihydrofuran-2-one,

3-(3,5-Dichlorophenylamino)-5-(3,5-dimethoxyphenyl)-5-methyl-dihydrofuran-2-one,

5-(Biphenyl-4-yl-)3-(3,5-dichlorophenylamino)-5-methyl-dihydrofuran-2-one,

3-(3,5-Dichlorophenylamino)-5-ethyl-5-phenyl-dihydrofuran-2-one,

3-(3,5-Dichlorophenylamino)-5-phenyl-5-n-propyl-dihydrofuran-2-one,

5-n-Butyl-3-(3,5-dichlorophenylamino)-5-phenyl-dihydrofuran-2-one,

3-(3,5-Dichlorophenylamino)-7a-phenyl-hexahydrobenzofuran,

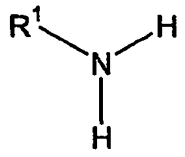
3-(3,5-Dichlorophenylamino)-7a-(3-methoxy-phenyl)-hexahydrobenzofuran-2-one

and

3-(3,5-Dichlorophenylamino)-8a-(3-methoxy-phenyl)-octahydrocyclo-hepta[b]furan-2-one

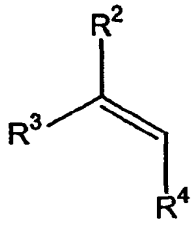
and the corresponding physiologically acceptable salts thereof, preferably the hydrochlorides thereof.

6. A process for the production of substituted γ-lactone compounds according to one of claims 1 to 5, characterised in that at least one amine component of the general formula II,



II

in which the residue R^1 has the meaning according to claims 1 to 5, is reacted with glyoxalic acid and at least one alkene component of the general formula III,



III

in which the residues R^2 to R^4 have the meaning according to claims 1 to 5, in the presence of at least one inorganic and/or organic acid in an organic solvent to yield at least one compound of the general formula I according to claims 1 to 5 and this is optionally purified using conventional methods and/or optionally isolated using conventional methods.

7. A process according to claim 6, characterised in that the glyoxalic acid is used in the form of the monohydrate thereof or in form of an aqueous solution.

8. A process according to claim 6 or 7, characterised in that trifluoroacetic acid is used as the organic acid.

9. A process according to one of claims 6 to 8, characterised in that the temperature during the reaction is 0 to 100°C, preferably 15 to 40°C.

10. A process according to one of claims 6 to 9, characterised in that the duration of the reaction is 0.25 to 12 hours.

11. A process for the production of substituted γ-lactone compounds according to one of claims 1 to 5, characterised in that at least one amine component of the general formula II according to claim 6 is reacted with glyoxalic acid and at least one alkene component of the general formula III according to claim 6 in an organic solvent, optionally in the presence at least one inorganic and/or organic acid with microwave irradiation or with exposure to ultrasound, preferably with microwave irradiation, to yield at least one compound of the general formula I according to claims 1 to 5 and this is optionally purified using conventional methods and/or optionally isolated using conventional methods.

12. A process according to claim 11, characterised in that the temperature during the reaction is 40 to 70°C, preferably 45 to 60°C.

13. A pharmaceutical preparation containing at least one substituted γ-lactone compound according to one of claims 1 to 5 and optionally physiologically acceptable auxiliary substances.

14. A pharmaceutical preparation according to claim 13 for combatting pain.

15. A pharmaceutical preparation according to claim 14 for combatting chronic pain.

16. A pharmaceutical preparation according to claim 14 for combatting neuropathic pain.

17. A pharmaceutical preparation according to claim 13 for the treatment or prevention of neurodegenerative diseases, preferably of Alzheimer's disease, Parkinson's disease or Huntington's chorea.

18. A pharmaceutical preparation according to claim 13 for the treatment or prevention of stroke.

19. A pharmaceutical preparation according to claim 13 for the treatment or prevention of cerebral ischaemia.

20. A pharmaceutical preparation according to claim 13 for the treatment or prevention of cerebral infarct.

21. A pharmaceutical preparation according to claim 13 for the treatment or prevention of cerebral oedema.

22. A pharmaceutical preparation according to claim 13 for anxiolysis.

23. A pharmaceutical preparation according to claim 13 for anaesthesia.

24. A pharmaceutical preparation according to claim 13 for the treatment or prevention of schizophrenia.

25. A pharmaceutical preparation according to claim 13 for the treatment or prevention of psychoses brought about by elevated amino acid levels.

26. A pharmaceutical preparation according to claim 13 for the treatment or prevention of AIDS dementia.

27. A pharmaceutical preparation according to claim 13 for the treatment or prevention of Tourette's syndrome.

28. A pharmaceutical preparation according to claim 13 for the treatment or prevention of inflammatory and/or allergic reactions.

29. A pharmaceutical preparation according to claim 13 for the treatment or prevention of depression.

30. A pharmaceutical preparation according to claim 13 for the treatment or prevention of mental health conditions.

31. A pharmaceutical preparation according to claim 13 for the treatment or prevention of epilepsy.

32. A pharmaceutical preparation according to claim 13 for the treatment or prevention of urinary incontinence.

33. A pharmaceutical preparation according to claim 13 for the treatment or prevention of pruritus.

34. A pharmaceutical preparation according to claim 13 for the treatment or prevention of tinnitus.

35. A pharmaceutical preparation according to claim 13 for the treatment or prevention of diarrhoea.

36. Use of at least one substituted γ-lactone compound according to one of claims 1 to 5 for the production of a pharmaceutical preparation for combatting pain, preferably chronic or neuropathic pain.

37. Use of at least one substituted γ-lactone compound according to one of claims 1 to 5 for the production of a pharmaceutical preparation for the treatment or prevention of neurodegenerative diseases, preferably of Alzheimer's disease, Parkinson's disease or Huntington's chorea, for the treatment or prevention of migraine, stroke, cerebral ischaemia, cerebral infarct, cerebral oedema, schizophrenia, psychoses brought about by elevated amino acid levels, AIDS dementia, Tourette's syndrome, inflammatory and/or allergic reactions, depression, mental health conditions, epilepsy, urinary incontinence, pruritus, tinnitus, diarrhoea, for anxiolysis or for anaesthesia.